

AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111

Serial Number: 09/872628

Filing Date: June 1, 2001

Title: REUSABLE THERMAL SOLUTION ATTACHMENT MECHANISM AND METHODS OF USING SAME

Assignee: Intel Corporation

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Dkt: 884,444US1IN THE CLAIMS

Please amend the claims as shown in the following detailed claim listing. The detailed claim listing is intended to reflect cancellation of claims 21-22, 31 and 35, amendment of previously pending claims 1, 3-4, 19, 25, 29, and 32-34, and addition of new claims 39-48. The specific amendments to individual claims are detailed in the following detailed claim listing.

1. (Currently Amended) An apparatus for attaching a thermal solution to a circuit board comprising:

a mounting plate having a mounting plate opening designed to allow the thermal solution to contact a processor, the processor located on the circuit board;

a backing plate connectable to the mounting plate, the backing plate designed to prevent flexure of the circuit board; and

a ~~connector~~ plurality of locking pins, each having a first end and a second end, the first end ~~attachable to~~ slideable within a slot in the mounting plate and the second end securable to the circuit board and to the backing plate, the ~~connector~~ plurality of locking pins capable of being aligned and positioned simultaneously, and designed to keep the mounting plate in contact with the processor.

2. (Canceled)

3. (Currently Amended) The apparatus of claim 1 wherein the ~~connector is a locking pin~~ second end of each of the plurality of locking pins is insertable through an existing tooling hole in the circuit board and ~~securable at its first end to a slot in the mounting plate.~~

4. (Currently Amended) The apparatus of claim 3 ~~wherein the slot comprises~~ there are four key-hole shaped slots in the mounting plate and ~~the locking pin comprises~~ four corresponding locking pins insertable into the four key-hole shaped slots, each slot having a shelf along which the corresponding locking pin can slide.

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5. (Original) The apparatus of claim 4 wherein each shelf is substantially horizontal or substantially angled.
6. (Previously Amended) The apparatus of claim 5 wherein the four corresponding locking pins have bosses slidable along the shelves.
7. (Original) The apparatus of claim 6 wherein the shelves are substantially horizontal and the thermal solution has a threaded base engageable with threads in the mounting plate opening.
8. (Original) The apparatus of claim 7 wherein pressure on the processor increases as the thermal solution is screwed into the mounting plate opening, further wherein thermal resistance between the processor and thermal solution is reduced.
9. (Previously Amended) The apparatus of claim 8 further comprising using a torque driver to screw the thermal solution into the mounting plate opening, wherein a predetermined amount of pressure can be imparted to the processor.
10. (Original) The apparatus of claim 9 wherein about 345 to 690 kPa of pressure is imparted to the processor after the thermal solution has been screwed into the mounting plate opening.
11. (Canceled)
12. (Previously Amended) The apparatus of claim 6 wherein the shelves are substantially angled and wherein pressure on the processor increases as the locking pins slide along the shelves in a downwardly direction.
13. (Original) The apparatus of claim 12 wherein about 345 to 690 kPa of pressure is imparted to the processor after the locking pins have been slid along the shelves.

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14. (Previously Amended) The apparatus of claim 1 wherein the apparatus attaches the thermal solution to the circuit board temporarily during testing.
15. (Original) The apparatus of claim 14 wherein the circuit board is less than 1.5 mm in thickness and 30 watts of power is removable by the thermal solution near a temperature of about 100°C.
16. (Original) The apparatus of claim 14 wherein the circuit board is greater than 1.5 mm in thickness and about 50 or more watts of power is removable by the thermal solution near a temperature of about 100°C.
17. (Previously Amended) The apparatus of claim 1 wherein the circuit board is greater than about 1.5 mm in thickness and the apparatus is used to permanently attach the thermal solution to the circuit board.
18. (Previously Amended) The apparatus of claim 1 wherein the mounting plate, backing plate and connector are each made from a material selected from the group consisting of aluminum, steel and plastic.
19. (Currently Amended) A removable thermal solution attachment mechanism comprising:
a mounting plate having a mounting plate opening designed to allow the thermal solution to contact a processor located in a package;
a backing plate designed to connect to the mounting plate; and
connectors a plurality of locking pins securable to the backing plate, each locking pin having one or more bosses insertable into slots in the mounting plate and backing plate, each slot having a substantially horizontal shelf, the plurality of locking pins capable of being aligned and positioned in the slots simultaneously, wherein the thermal solution can impart imparts a force

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on the package when the thermal solution is secured to the mounting plate opening, further wherein the thermal solution can remove heat from the processor.

20. (Original) The mechanism of claim 19 wherein the thermal solution is an active or passive thermal solution.

21-22. (Canceled)

23. (Original) The mechanism of claim 19 wherein the package is a socketed package securable to a circuit board.

24. (Previously Amended) The mechanism of claim 19 wherein the backing plate and connectors are integrated into a bench top fixture.

25. (Currently Amended) A method for attaching a thermal solution to a circuit board comprising:

placing a mounting plate on top of a processor, the processor located on a top surface of the circuit board and the mounting plate having a mounting plate opening designed to allow the thermal solution to contact a processor;

simultaneously aligning slots on the mounting plate with locking pins securable to the circuit board;

providing a backing plate designed to give support to the circuit board, the locking pins also securable to the backing plate;

simultaneously inserting one end of each locking pin into each mounting plate slot;

simultaneously sliding each locking pin along a shelf located in each mounting plate slot;

and

securing a thermal solution to the mounting plate ~~wherein pressure is applied to a package secured to the processor, the package located beneath the thermal solution.~~

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26. (Canceled)
27. (Previously Amended) The method of claim 25 further comprising:
testing the circuit board;
removing the attachment mechanism from the circuit board; and
reusing the attachment mechanism with another circuit board.
28. (Previously Amended) The method of claim 25 further comprising using the circuit board in normal operation, wherein the attachment mechanism is used to permanently attach the thermal solution to the circuit board.
29. (Currently Amended) A method for temporarily attaching a thermal solution to a circuit board comprising:
providing a thermal solution attachment mechanism having first and second plates and a set of connectors to connect the first and second plates together;
placing a circuit board between the first and second plates wherein a thermal solution secured to an opening in the first plate contacts a package located on the circuit board;
simultaneously inserting the set of connectors into slots on the first plate;
simultaneously sliding the set of connectors along shelves located in the slots, wherein the first and second plates are connected;
securing a thermal solution to an opening in the first plate wherein the thermal solution contacts a package located on the circuit board;
testing the circuit board, wherein heat is removed by the thermal solution from a processor located in the package; and
removing the thermal solution attachment mechanism from the circuit board.
30. (Original) The method of claim 29 further comprising reusing the thermal solution attachment mechanism on another circuit board.

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31. (Canceled)

32. (Currently Amended) The method of claim 30 wherein the shelves are substantially horizontal or angled and pressure is applied to the processor by securing the thermal solution to the opening.

33. (Currently Amended) The method of claim 32 ~~further comprising applying 29 wherein~~ the shelves are substantially angled and pressure is applied to the processor by sliding the set of connectors along the substantially angled shelves in a downwardly direction.

34. (Currently Amended) An apparatus comprising:

a mounting plate having a mounting plate opening designed to allow a thermal solution to contact a processor, the processor located on a circuit board, wherein the circuit board is greater than about 1.5 mm in thickness; and

four locking pins designed to keep the mounting plate in contact with the processor, each locking pin having a first end and a second end, the first end of each locking pin simultaneously securable to a corresponding key-hole shaped slot in the mounting plate, wherein each key-hole shaped slot has a shelf along which the locking pin can slide, the second end of each locking pin securable to the circuit board.

35. (Canceled)

36. (Previously Added) The apparatus of claim 34 wherein the thermal solution has a threaded base engageable with threads in the mounting plate opening.

37. (Previously Added) The apparatus of claim 34 wherein about 50 or more watts of power is removable by the thermal solution near a temperature of about 100°C.

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38. (Previously Added) The apparatus of claim 34 wherein the apparatus attaches the thermal solution to the circuit board temporarily during testing.

Please add the following new claims:

39. (New) A removable thermal solution attachment mechanism comprising:
a mounting plate having a mounting plate opening designed to allow the thermal solution to contact a processor located in a package;
a backing plate designed to connect to the mounting plate; and
a plurality of locking pins securable to the backing plate, each locking pin having one or more bosses insertable into slots in the mounting plate, each slot having a substantially angled shelf with a top and bottom, the plurality of locking pins capable of being aligned and positioned in the slots simultaneously, wherein the plurality of locking pins can impart a force on the package.
40. (New) The mechanism of claim 39 wherein pressure on the package increases as the plurality of locking pins are slid along the angled shelves in a downwardly direction.
41. (New) The apparatus of claim 39 wherein about 345 to 690 kPa of pressure is imparted to the package when the locking pins are secured in place at the bottom of the angled shelves.
42. (New) The apparatus of claim 39 wherein the thermal solution is hard mounted to the mounting plate.
43. (New) The apparatus of claim 39 where up to about 800 kPa of pressure is imparted to the processor when the locking pins are secured in place at the bottom of the angled shelves.
44. (New) The apparatus of claim 43 wherein each angled shelf is at an angle of about 45 degrees.

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45. (New) The apparatus of claim 25 wherein the slots have substantially horizontal shelves and the thermal solution has a threaded base engageable with threads in the mounting plate opening, wherein increasing pressure is applied to a package secured to the processor as the thermal solution is being screwed into the mounting plate opening, the package located beneath the thermal solution.

46. (New) The apparatus of claim 25 wherein the slots have substantially angled shelves and increasing pressure is applied to a package secured to the processor as the locking pins are being slid along the shelves in a downwardly direction, the package located beneath the thermal solution.

47. (New) The apparatus of claim 1 wherein the thermal solution contacts the processor indirectly.

48. (New) The apparatus of claim 47 wherein an interposer board is located between the processor and the thermal solution and the thermal solution is in direct contact with a secondary processor located on the interposer board.